Enabling Secure Ad-hoc Collaboration

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Goals

- support collaboration
  - — able to form ad-hoc
  - — add users and services on the fly, as needed
  - — scalable to large established collaborations
- flexible security
  - — includes a range of mechanisms
  - — allows appropriate levels of security
- minimal dependence on any single resource or server
  - — these provide added value when present
- easy to collaborate
  - — no one will use it otherwise

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Overview

- what needs to be reevaluated
  - — communication
  - — authentication and authorization
- applications
  - — information-sharing tool (scishare)
  - — Pervasive Collaborative Computing Environment (PCCE) secure messaging tool
- conclusion

Overview

- **secure group communication**
  - — architectures
  - — InterGroup protocols
  - — Secure Group Layer
- information-sharing tool (scishare)
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Secure Group Communication

- (reliably) communicate with the other collaborators
- security
  - — know the identities of the other collaborators
  - — protect information
  - — authorize users
- scalability

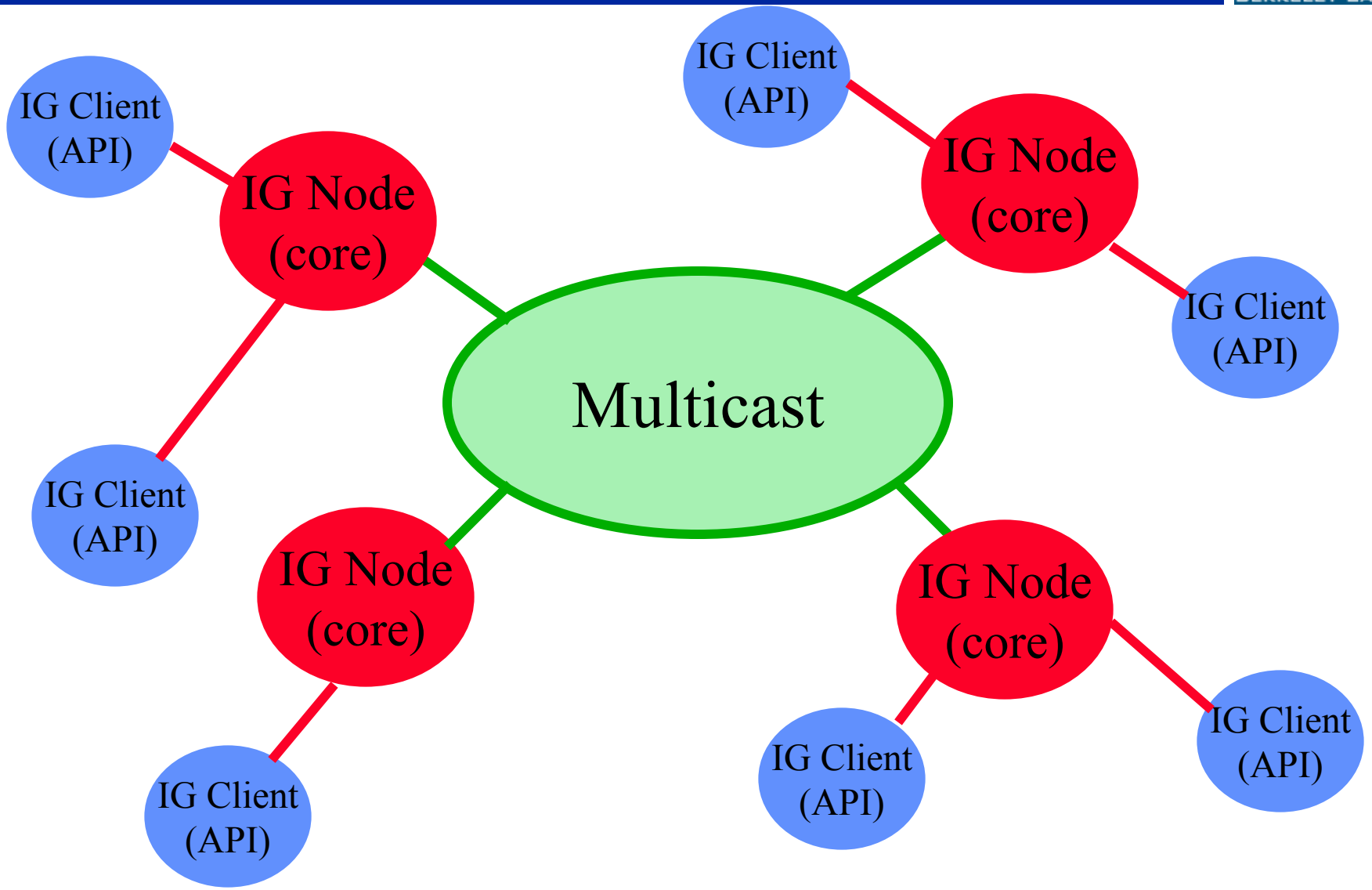
Achieving Secure Group Communication (1)

- unicast mechanisms (TCP and SSL)
  - — architectures
    - centralized server
    - completely connected mesh
    - overlay network
  - — advantages
    - existing infrastructure
    - familiar to developers
  - — disadvantages
    - inefficient
    - single point of failure
    - hard to scale
    - complex to manage

Achieving Secure Group Communication (2)

- IP multicast-based mechanisms (InterGroup and Secure Group Layer)
  - — add to IP multicast
    - acknowledgments and retransmissions
    - membership
    - message ordering
  - — advantages
    - efficient
    - easier to scale
  - — disadvantages
    - lack of IP multicast infrastructure deployment
    - unfamiliar paradigm to developers

InterGroup Architecture



InterGroup Design

- node
  - automatically handles membership, message ordering and retransmission of missed messages
  - uses IP Multicast to transmit messages
- client (API)
  - usable as a library that connects via TCP to the InterGroup node
  - allows machines without multicast connectivity to participate
  - developed for ease of use

Implementation

- current release v1.5
  - — IG Node (Java)
    - deamon listening for client connections
    - flow/congestion control very crude
    - reliable group ordered delivery
  - — IG Client (Java, C++, Python)
    - connects to IG node using TCP
    - C++ client (unix flavors only)
    - Python client is SWIG wrapping of the C++ client

Secure Group Layer Goals

- provide a secure channel for the group
- authorization of group members (individually enforced)
- group key management (not centralized)
- group security optional
- portable implementation

SGL Implementation

- prototype release (in progress) in C++
  - — built using recently proven cryptographic algorithms
  - — targeted for controlled environments
  - — support for anonymous, password-based, and certificate-based modes
  - — uses InterGroup as transport
  - — same API as InterGroup (with security extensions)
    - similar to SSL/TCP model

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Scishare Goals

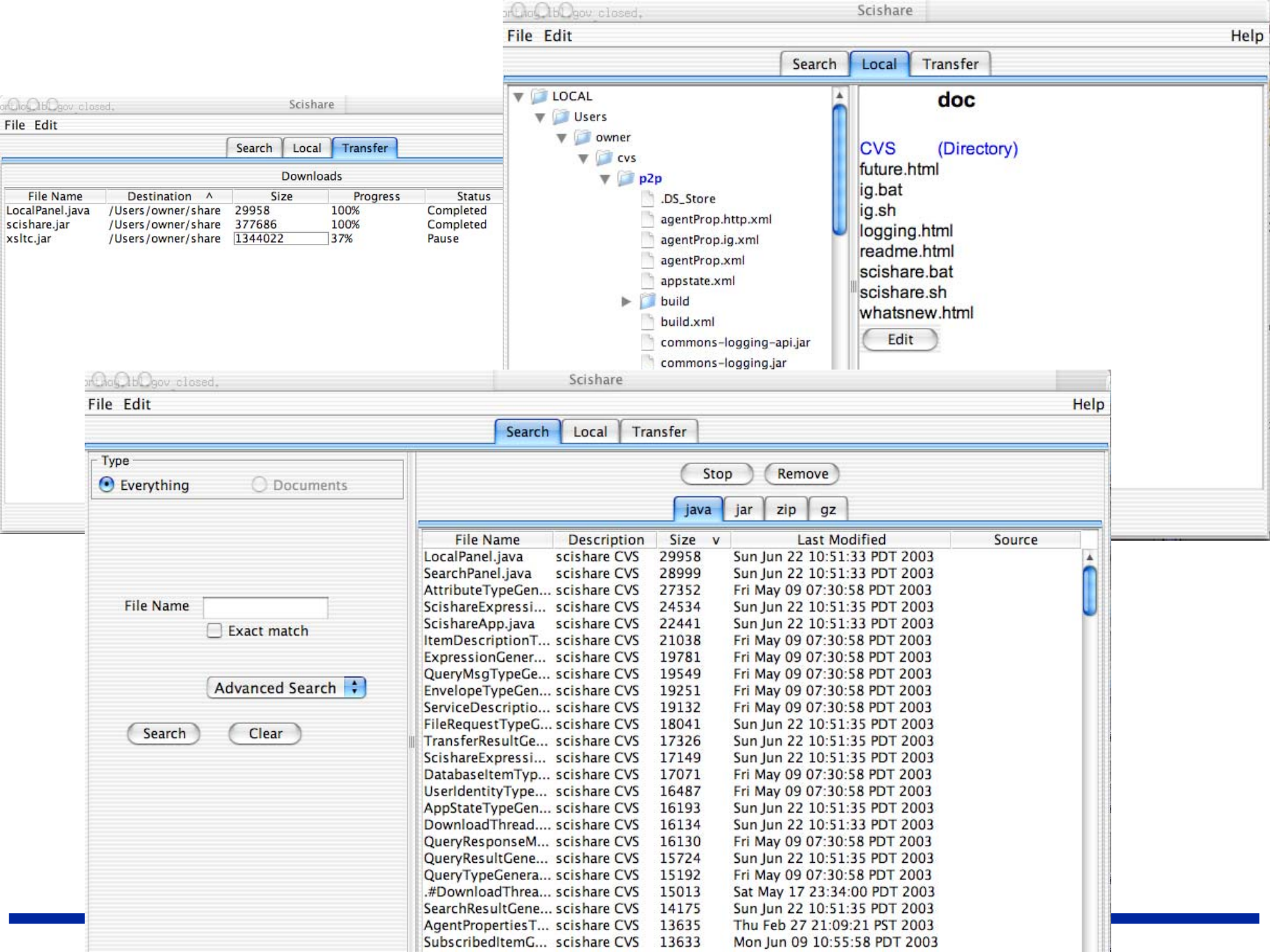
- store and manage information on local storage facilities
- share information with remote participants
- lightweight
- scalable
- secure

What's Different Here?

- use of group communication mechanisms for searching
- security mechanisms and policies for ad hoc information sharing based on
  - — Secure Group Layer (SGL) for securing group communication
  - — support for X.509 identity certificate-based authentication and authorization

Implementation

- initial release scheduled for Q3 2003
- software in Java (requires Java 1.4)
  - — a simple messaging framework for resource discovery (based on XML)
  - — information discovery between hosts using InterGroup and HTTP for communication
  - — search for files by file name, description, and file size
  - — download a file whose metadata was returned as a result of a search
  - — manage sharing of local files


Scishare
File Edit
Help
Search
Local
Transfer
LOCAL
Users
owner
cvs
p2p
.DS_Store
agentProp.http.xml
agentProp.ig.xml
agentProp.xml
appstate.xml
build
build.xml
commons-logging-api.jar
commons-logging.jar
doc
CVS (Directory)
future.html
ig.bat
ig.sh
logging.html
readme.html
scishare.bat
scishare.sh
whatsnew.html
Edit
Downloads
File Name
Destination
Size
Progress
Status
LocalPanel.java
/Users/owner/share
29958
100%
Completed
scishare.jar
/Users/owner/share
377686
100%
Completed
xsltc.jar
/Users/owner/share
1344022
37%
Pause
Type
Everything
Documents
File Name
Exact match
Advanced Search
Search
Clear
Stop
Remove
java
jar
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gz
File Name
Description
Size
Last Modified
Source
LocalPanel.java scishare CVS 29958 Sun Jun 22 10:51:33 PDT 2003
SearchPanel.java scishare CVS 28999 Sun Jun 22 10:51:33 PDT 2003
AttributeTypeGen... scishare CVS 27352 Fri May 09 07:30:58 PDT 2003
ScishareExpressi... scishare CVS 24534 Sun Jun 22 10:51:35 PDT 2003
ScishareApp.java scishare CVS 22441 Sun Jun 22 10:51:33 PDT 2003
ItemDescriptionT... scishare CVS 21038 Fri May 09 07:30:58 PDT 2003
ExpressionGener... scishare CVS 19781 Fri May 09 07:30:58 PDT 2003
QueryMsgTypeGe... scishare CVS 19549 Fri May 09 07:30:58 PDT 2003
EnvelopeTypeGen... scishare CVS 19251 Fri May 09 07:30:58 PDT 2003
ServiceDescriptio... scishare CVS 19132 Fri May 09 07:30:58 PDT 2003
FileRequestTypeG... scishare CVS 18041 Sun Jun 22 10:51:35 PDT 2003
TransferResultGe... scishare CVS 17326 Sun Jun 22 10:51:35 PDT 2003
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UserIdentityType... scishare CVS 16487 Fri May 09 07:30:58 PDT 2003
AppStateTypeGen... scishare CVS 16193 Sun Jun 22 10:51:35 PDT 2003
DownloadThread.... scishare CVS 16134 Sun Jun 22 10:51:33 PDT 2003
QueryResponseM... scishare CVS 16130 Fri May 09 07:30:58 PDT 2003
QueryResultGene... scishare CVS 15724 Sun Jun 22 10:51:35 PDT 2003
QueryTypeGenera... scishare CVS 15192 Fri May 09 07:30:58 PDT 2003
.#DownloadThrea... scishare CVS 15013 Sat May 17 23:34:00 PDT 2003
SearchResultGene... scishare CVS 14175 Sun Jun 22 10:51:35 PDT 2003
AgentPropertiesT... scishare CVS 13635 Thu Feb 27 21:09:21 PST 2003
SubscribedItemG... scishare CVS 13633 Mon Jun 09 10:55:58 PDT 2003

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- **Pervasive Collaborative Computing Environment (PCCE) secure messaging tool**
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Current PCCE Architecture

- PCCE Server
  - maintains long-lived information (authorized users, available tools, system venues, descriptions, etc.)
  - performs authentication of users (entry point into the system)
- IRC Server
  - back-end for messaging
  - maintains short-lived information (user-created venues, venue participants, etc.)
- PCCE Client
  - user front end
  - communicates with other clients through servers

Future PCCE Architecture

- InterGroup/SGL
  - — used for exchange of short and long lived information
  - — replaces IRC server as back-end for messaging
- PCCE Server
  - — still maintains long-lived information
  - — grants users additional capabilities
- PCCE Client
  - — maintain short-lived information
  - — entry point to the system (limited capabilities without server)

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Conclusion

- InterGroup and SGL provide core communication services for ad-hoc or infrastructure-enabled collaborations
- scishare example of tool designed with this model in mind
- PCCE example of moving from client-server model to ad-hoc model

Authorization and Authentication in Ad Hoc Environments

- central database that most existing systems use may not be available
- shared secrets not feasible in many situations and not scalable
- independent (local) databases difficult to maintain and lead to inconsistencies
- real-time interfaces do not work for unsupervised applications
- likely solution is some combination of the above

More info

- InterGroup protocols
  http://www-itg.lbl.gov/CIF/GroupComm/InterGroup/
- SGL
  http://www-itg.lbl.gov/SecGrpComm/index.html
- scishare
  http://www-itg.lbl.gov/P2P/file-share/
- PCCE
  http://www-itg.lbl.gov/Collaboratories/pcce.html